

**PCT**WORLD INTELLECTUAL PROPERTY  
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INTERNATIONAL APPLICATION PUBLISHED UNDER T

WO 9606301A1

(51) International Patent Classification <sup>6</sup> :

F17C 13/04, A61M 16/18

A1

(11) International Publication Number:

WO 96/06301

(43) International Publication Date:

29 February 1996 (29.02.96)

(21) International Application Number: PCT/SE95/00954

(22) International Filing Date: 23 August 1995 (23.08.95)

(30) Priority Data:

9402828-9

24 August 1994 (24.08.94)

SE

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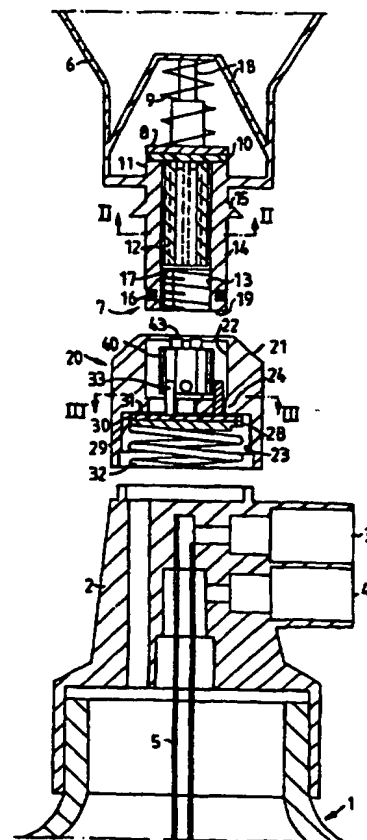
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P.O. Box 3137, S-103 62 Stockholm (SE).(81) Designated States: JP, US, European patent (AT, BE, CH, DE,  
DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).**Published***With international search report.**Before the expiration of the time limit for amending the  
claims and to be republished in the event of the receipt of  
amendments.**In English translation (filed in Swedish).*

(54) Title: ANAESTHETIC GAS FILLING DEVICE

**(57) Abstract**

Transfer device for transferring an anaesthetic from a storage bottle (6) to a container (1) by means of an adapter (20). The adapter (20) is provided with a bore (22) for cooperating with a connection cylinder (7) of the storage bottle (6). There is also an opening element (40) positioned in the bore (22) and provided with outer threads (42) for cooperating with inner threads (17) in connection with the cylinder (7). By screwing-down the connection cylinder (7) into the bore (22) the lower actuator surface (19) of the connection cylinder cooperates with pins (33) of a one-way valve (28) in the adapter (20) and opens the one-way valve. Thereafter a projecting pin (43) on the opening element (40) cooperates with an actuator member (12) positioned within the connection cylinder (7) and opens a one-way valve (8) in the storage bottle (6). In this way the contents of the storage bottle (6) is transferred to a container (1) via the adapter (20). The one-way valve (28) in the adapter is opened before the one-way valve (8) in the storage bottle (6).



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## 5 TITLE

## Anaesthetic gas filling device

## FIELD OF THE INVENTION

10 The present invention relates to a device for transferring an anaesthetic from a storage bottle to a container in connection with an anaesthesia apparatus.

## STATE OF THE ART

15 As disclosed in the patent EP-B1-449 545 anaesthetics are now available which have boiling points at atmospheric pressure which are well below 40°C. In particular, desflurane has a boiling point of between 20°C and 25°C. Such an anaesthetic requires particular measures when  
20 filling from a storage bottle into the anaesthesia apparatus due to its volatility and also requires, in certain cases, a restructuring of the corresponding vaporizer, where desflurane is used in higher concentrations, for example 18% of the total gas flow.

25 The handling of anaesthetics and the requirements of the filling system are disclosed in the international standard ISO 5360:1993 (first edition 15-02-1993). It is clear from this standard that the leakage to atmosphere of fluid or gaseous anaesthetics may not exceed 0,5 ml fluid  
30 per filling. It is naturally desired to reduce such leakage even further and ultimately to completely eliminate it.

For the anaesthetic desflurane which has a very low boiling point, the storage bottle, in which the anaesthetic is kept during transport from the point of manufacture to  
35 the point of use, is provided with a non-return valve in order that the anaesthetic cannot boil away if the bottle is left open. This makes it more difficult to convey fluid

from the bottle to the anaesthesia gasifier, particularly since the discharge to the surroundings is to be minimized.

5 Examples of vaporizers for anaesthetics are disclosed in the patent US-A-4 919 125, US-A-5 322 057 as well as EP-B1-448 954. In these patents, the vaporizer is provided with a vessel, to which the anaesthetic is transferred and where the vaporization itself occurs (or the atomization into small fluid droplets). Normally a relatively large amount of anaesthetic is transferred to these apparatus, sufficient for several hours' use. After use the anaesthetic has to be returned to the storage container. This handling of the anaesthetic gives rise to large losses to the surroundings.

10 The patent EP-B1-231 513 describes a vaporizer with a removable container for anaesthetic. This container can be the storage vessel, in which the anaesthetic is transported, or a separate container, to which the anaesthetic is conveyed. Since the anaesthetic is only in a relatively short tube which leads to a vaporizer, in principal no loss of the anaesthetic occurs upon changing the anaesthetic.

20 A process for filling an anaesthesia apparatus with anaesthetic is disclosed in the aforementioned EP-B1-448 954. In this patent, a transfer device is used consisting of two link arms joined to each other, said link arms being rotatable relative to each other and comprising a valve. When the link arms are positioned in line with each other, the valve is closed and when the link arms are positioned at 90° relative to each other, the valve is open and transfer to and from the anaesthesia apparatus occurs. This refilling device is well suited for earlier-known anaesthetics but cannot be used without modification for desflurane, due to the one-way valve in its transport bottle.

## SUMMARY OF THE INVENTION

The object of the present invention is to provide a transfer device, with which anaesthetic present in a transport bottle with a one-way valve can be transferred to a container in an anaesthesia apparatus.

The features of the invention are defined in the appended patent claims, to which reference is made.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail with reference to a preferred embodiment shown in the drawings.

Fig. 1 is an exploded view, in cross-section, of a transfer device according to the invention.

Fig. 2 is a cross-sectional view taken along the line II-II in fig. 1.

Fig. 3 is a cross-sectional view taken along the line III-III in fig. 1.

Fig. 4 is a perspective view of an opening element in the transfer device according to fig. 1.

Fig. 5 is a cross-sectional view similar to fig. 1 and showing a first position during the filling operation.

Fig. 6 is a cross-sectional view similar to fig. 5 and showing a second position during the filling operation.

Fig. 7 is a cross-sectional view similar to fig. 5 and showing a third position during the filling operation.

## DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The present invention is described below in connection with an anaesthesia apparatus according to EP-B1-231 513 with a separate container, to which anaesthetic is transferred and which is then attached to the anaesthesia apparatus. Such a container 1 is shown at the bottom in fig. 1. The container is manufactured of dark-coloured glass and has a connection cap 2 at its upper end.

The connection cap 2 has two openings 3, 4 intended for connection to the anaesthesia apparatus. The upper opening 3 is connected to a tube 5 which extends down into the container 1, practically speaking to the bottom thereof. Air is supplied via the lower opening 4, whereby anaesthetic present in the container 1 is pressed out through the tube 5 and the opening 3 for vaporization in the anaesthesia apparatus.

Fig. 1 also shows a storage bottle 6 for a volatile anaesthetic such as desflurane. The container 6 is provided at its orifice with a separate connection device 7. The connection device comprises a one-way valve 8 with a spring 9 which presses a rubber membrane 10 against a valve seat 11. The one-way valve also has an actuator member 12 which runs in a hole 13 in the connection device.

The connection device consists of a cylinder 7 having a substantially planar outer surface 14 ending with a shoulder 15. The outer surface has, just above its lower end 19 as viewed according to fig. 1, an O-ring 16 in order to provide a seal. The inner surface 13 of the connection cylinder 7 is provided with an inner thread 17 of specific type for the anaesthetic in question, a so-called desflurane-thread.

The one-way valve is further provided with holding legs 18 for guiding and holding in place the spring 9.

The function of the one-way valve is very simply that the spring 9 holds the rubber membrane 10 in contact with the valve seat 11 in the normal case. By pushing the actuator member 12 down against the force of the spring 9, the one-way valve opens and the contents in the bottle can pass out through the cylinder 13 and past the actuator member 12 due to its cross-section which is shown in more detail in fig. 2.

In order to adapt the aforementioned storage bottle 6 to the filling of the container 1 with the cap 2, an adapter 20 is provided in accordance with the invention

(see fig. 1). The adapter 20 is fixed to the cap 2 by means of adhesive, ultrasound welding, screw connection or in any other suitable way.

5 The adapter 20 is formed by an essentially cylindrical housing 21 with a first bore 22 from one side and a second bore 23 from the other side. A web 24 is positioned between the bores 22 and 23. The web is provided with a plurality of continuous holes as shown in the cross-section according to fig. 3. A first central hole 25 is provided  
10 with threads. Additionally there are three small holes 26 which form guides for pins of a one-way valve, as will be described in more detail below. Lastly there are three medium-sized holes 27, through which anaesthetic can pass from the bore 22 to the bore 23 and vice versa.

15 The adapter is also provided with a one-way valve 28 consisting of a plate 29, on which a rubber membrane 30 is positioned for contact with a valve seat 31 which consists of the lower surface of the web 24 in fig. 1. There is also a spring 32 which presses the rubber membrane  
20 30 against the valve seat 31. The plate 29 is provided with three pins 33 which extend from the plate 29 upwardly through the hole 26 in the web 24 as is clearly shown in fig. 1.

25 The adapter 20 is further provided with an opening element 40 which is shown in more detail in fig. 4. The opening element 40 is positioned in the central hole 25. The opening element is thus provided with a downwardly extending threaded pin 41 which is positioned in the hole  
30 25. The opening element 40 is substantially cylindrical and is provided with an outer thread 42 of specific type for the anaesthetic in question, for cooperation with the desflurane thread 17 in the connection cylinder 7 of the storage bottle 6. The opening element 40 is further  
35 provided with a projecting pin 43 at its upper end, the function of which will be described in more detail below. The opening element 40 is additionally provided with a

continuous bore 44 which ends in several radial holes 45 so that a passage is formed through the opening element 40.

As is clear from fig. 1, the opening element 40 is positioned centrally in the upper bore 22 of the adapter 20.

The function of the transfer device according to the invention can be seen more clearly from figs. 5-7.

Fig. 5 shows the storage bottle 6 brought into engagement with the adapter 20. The upper bore 22 of the adapter 20 has a diameter such that the connection cylinder 7 of the storage bottle fits into the bore 22 and so that the O-ring 16 seals against the inner surface of the bore 22.

In the position shown in fig. 5, the inner thread 17 on the connection cylinder 7 has come into contact with the outer thread 42 on the opening element 40 in the adapter. A closed space between the one-way valve 8 in the storage bottle 6 and the one-way valve 28 in the adapter 20 is formed. This closed space has a small a volume as possible.

The storage bottle 6 is then rotated relative to the adapter 20, whereby the thread 17 in the connection cylinder 7 cooperates with the thread 42 of the opening element 40. This cooperation only functions if the adapter 20 is adapted to the storage bottle 6 so that the wrong anaesthetic cannot be transferred via the adapter by mistake.

The spring 32 of the one-way valve 28 is suitably weaker than the spring 9 in the one-way valve 8.

In fig. 6, the connection cylinder 7 has come so low down in the bore 22 that the lower surface 19 of the connection cylinder 7 has reached the pins 33 of the one-way valve 28. The pins 33 are positioned in a circle with such a diameter that cooperation occurs with the lower actuation surface 19 of the connection cylinder 7, seen as in fig. 6.



Continued screwing-down of the storage bottle 6 according to fig. 6 causes the one-way valve 28 to be opened by a cooperation between the pins 33 and the actuation surface 19. The one-way valve 28 is thus opened first.

Upon continued screwing-down of the storage bottle 6 into the adapter 20 (see fig. 7) the one-way valve 28 is opened completely. At the same time the projecting pin 43 of the opening element 40 cooperates with the actuator member 12 of the one-way valve 8 in the storage bottle 6 so that the one-way valve 8 will also open, however only after opening of the one-way valve 28. This position is shown in fig. 7 and filling of the contents in the storage bottle 6 to a container 1 positioned below the adapter 20 occurs (see fig. 1).

The anaesthetic can pass the actuator member 12 due to its cross-section, as is clear from fig. 2. The anaesthetic can additionally pass the opening element 40 since the outer thread 42 is located on four fingers 46 (see fig. 4) which leave passages between them for the anaesthetic. The anaesthetic also passes through the holes 27 in the web 24 of the adapter 20.

The filling sequence ends when the container 1 has been filled to the desired amount by screwing-back the storage container 6 so that the one-way valve 8 closes.

The anaesthetic which remains in the space around the actuator member 12, the opening element 40 and above the one-way valve 28 now passes down into the container 1 below the one-way valve 28 so that said space becomes substantially air-filled. In this way air passes from the container 1 up through hole 45 and the bore 44 within the opening element 40. This emptying can be further facilitated by a gentle inclination of the storage bottle 6 and the container 1 in the position where the one-way valve 8 has just been closed and before the one-way valve 28 closes, i.e. a position between fig. 6 and fig. 7. There-

after screwing-out of the connection cylinder 7 from the adapter 20 continues and in the position which is shown in fig. 6 the one-way valve 28 also closes.

5       Upon continued screwing-out to the position shown in fig. 5 a mild under-pressure occurs in the space between the one-way valve 8 and the one-way valve 28 which has to be overcome, but which however occurs without any problem.

10       The invention has been described above with reference to filling of a container 1. It is perceivable that the adapter 20 according to the invention can similarly be arranged directly on an anaesthesia apparatus and connected with an inner container positioned within this. Since the one-way valve in the storage bottle 6 is not opened before a sealing cooperation is obtained between the connection  
15       cylinder and the adapter 20, the storage bottle 6 can be handled in any position without risk of loss. Refilling preferably occurs in a vertical position with the storage bottle 6 upside down as shown in fig. 1, or at a small angle relative to the vertical.

20       The invention is not limited to the embodiment described above, but can be modified within the scope of the invention, as is obvious for a skilled man. The invention is limited only by the appended patent claims.

## 5 CLAIMS

1. Transfer device for transferring a volatile medium, preferably an anaesthetic, from a storage bottle (6) to a container (1), whereby the storage bottle (6) comprises a connection cylinder (7) and a one-way valve (8) with associated actuator member (12), c h a r a c t e r - i z e d b y an adapter (20) arranged between the storage bottle (6) and the container (1), whereby the adapter comprises:

15 a first surface (22) for sealing cooperation with a second surface (14) of the connection cylinder (7);

an opening means (33) for cooperation with the connection cylinder (7) for opening a one-way valve (28) in the adapter; and

20 an opening element (40) for cooperation with the actuator member (12) and opening of the one-way valve (8) in the storage bottle (6).

2. Transfer device according to claim 1, c h a r a c t e r i z e d i n that the connection cylinder (7) is provided with a thread (17) of specific type for said anaesthetic, and in that the adapter (20) is provided with a corresponding thread (42) for cooperation with the thread (17) of the connection cylinder.

3. Transfer device according to claim 1 or 2, c h a r a c t e r i z e d i n that the opening member for the one-way valve (28) of the adapter consists of a plurality of pins (33) which cooperate with the lower surface (19) of the connection cylinder (7).

4. Transfer device according to claim 1, 2 or 3, c h a r a c t e r i z e d i n that the one-way valve

(28) in the adapter (20) is opened before the one-way valve (8) in the storage bottle (6).

5 5. Transfer device according to any one of claims 1-4, characterized in that the outer surface (14) of the connection cylinder (7) is provided with a sealing arrangement, preferably an O-ring (16), for sealing against an inner surface (22) of the adapter.

10 6. Transfer device according to claim 5, characterized in that the connection cylinder (7) of the storage bottle is provided with an inner thread (17) which cooperates with an outer thread (42) in the opening element (40) only when a seal is present between the outer surface (14) of the connection cylinder (7) and the inner surface (22) of the adapter (20).

15 7. Transfer device according to any one of the preceding claims, characterized in that the connection cylinder (7) is provided with an actuator member (12) positioned within the cylinder and extending from said one-way valve (8) positioned at one end of the cylinder and towards an actuator surface (19) positioned at the other end of the cylinder.

20 8. Transfer device according to claim 7, characterized in that the adapter is provided with an opening element (40) positioned in the bore (22) of the adapter and provided with a projecting pin (43) for cooperation with said actuator member (12) in the connection cylinder (7).

25 9. Transfer device according to claim 8, characterized in that actuator member (12), the opening element (40) and the bore (22) are provided with passages so that an anaesthetic can pass the one-way valve (28) when this is opened, past the actuator member (12), the opening element (40) and into the bore (22) and past the one-way valve (28) of the adapter (20) as well as to  
30  
35 the container (1).

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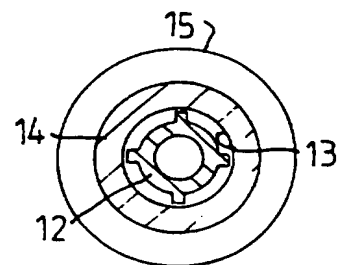
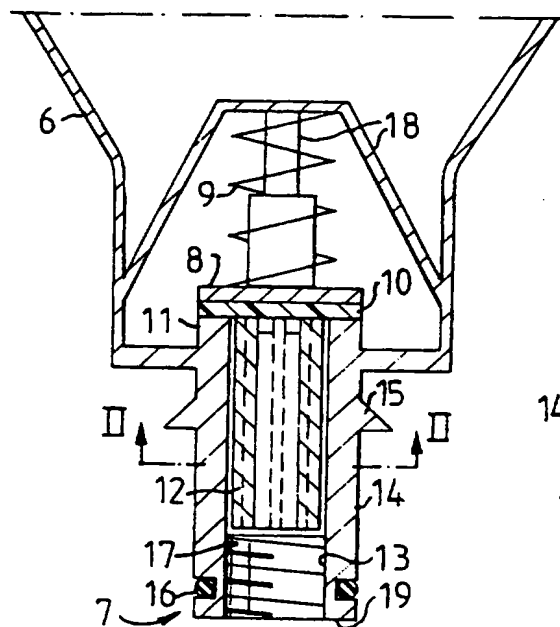


FIG. 2

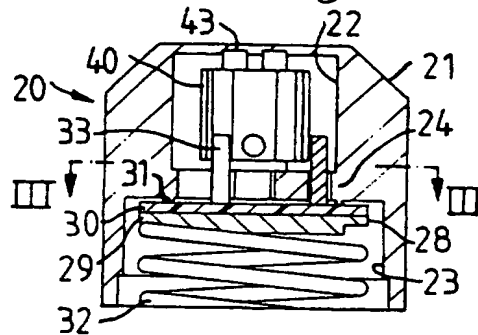


FIG. 3

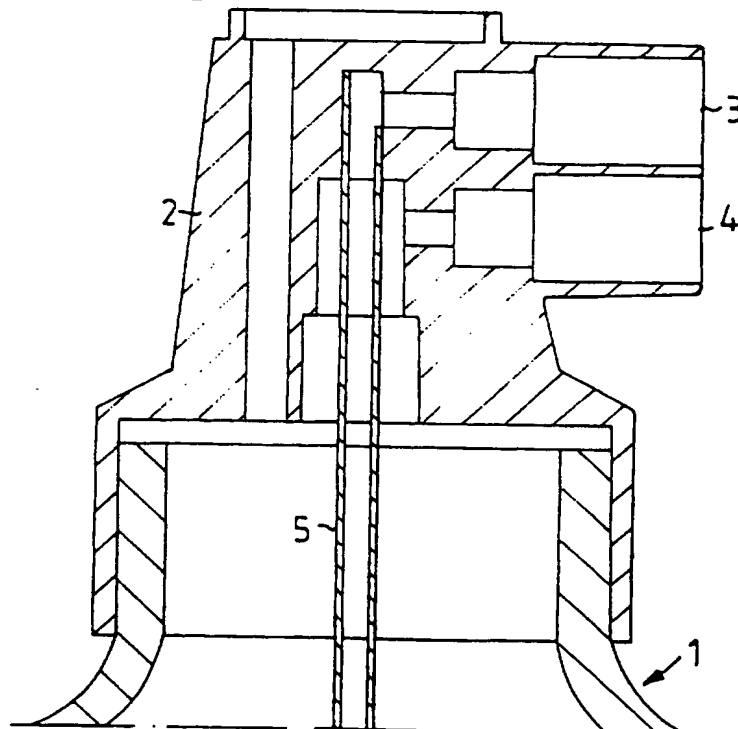


FIG. 1

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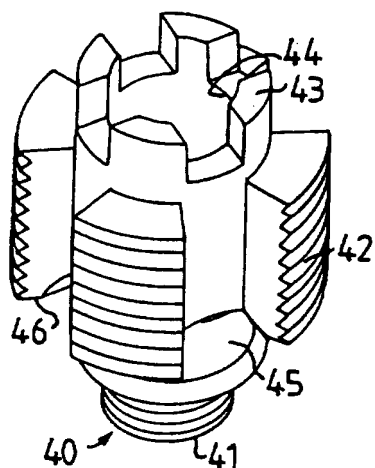


FIG. 4

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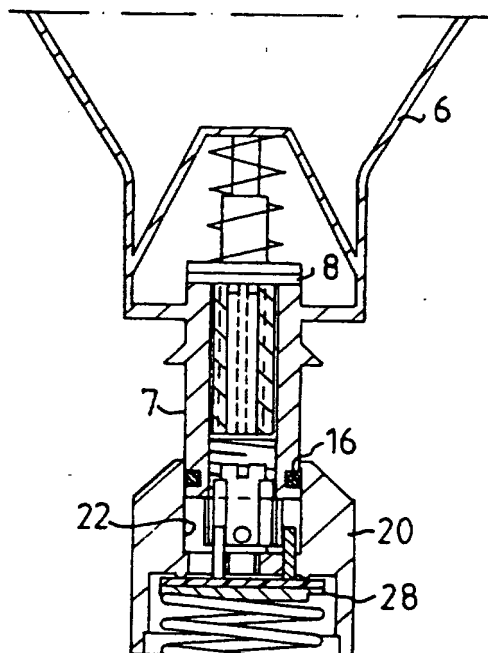


FIG. 5

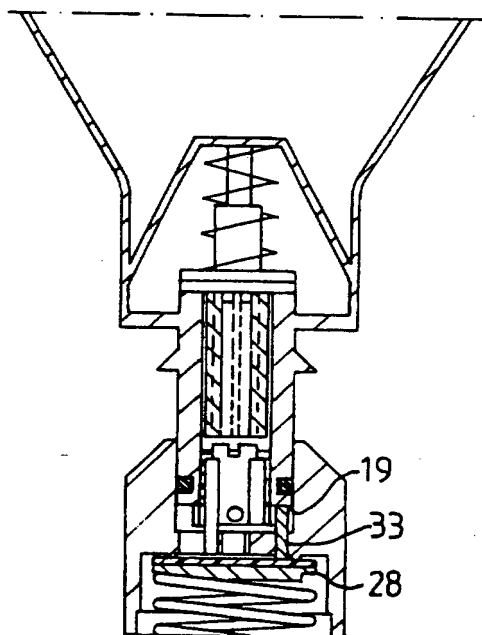


FIG. 6

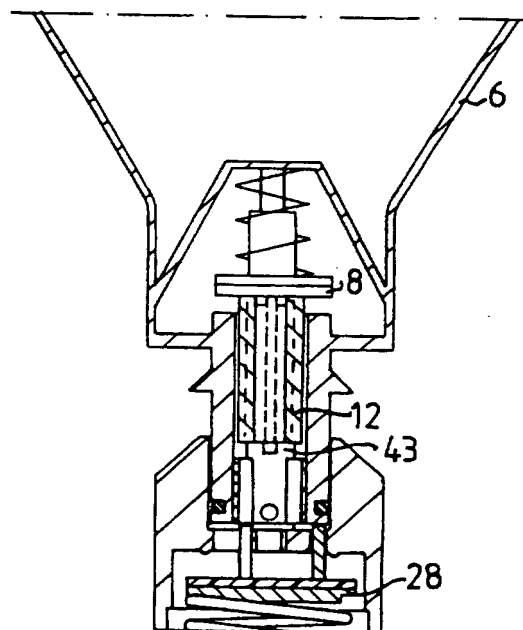


FIG. 7

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 95/00954

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: F17C 13/04, A61M 16/18

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SE 464560 B (SIEMENS-ELMA AB), 13 May 1991 (13.05.91), page 2, line 20 - page 4 --	1-9
A	SE 464964 B (DRÄGERWERK AG), 8 July 1991 (08.07.91), page 5, line 4 - line 35 --	1-9
A	EP 0242979 A2 (THE BOC GROUP PLC), 28 October 1987 (28.10.87), column 3, line 25 - line 54 --	1-9
A	EO 447202 A2 (THE BOC GROUP PLC), 18 Sept 1991 (18.09.91), column 3, line 50 - column 4, line 48 -- -----	1-9



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11/12/95

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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E0-A2- 447292	18/09/91	NONE	